40. (New) A method of manufacturing a device, comprising the steps of:

transferring a circuit pattern onto a substrate using said projection apparatus of claim 35;

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developing the resultant substrate.--.

REMARKS

Summary

Amended independent Claims 1 and 15 recite at least two features not disclosed or suggested by the patents to <u>Meisberger, et al.</u> and <u>Wu, et al.</u> Therefore, are the outstanding rejection of these claims over this art still proper?

Status of the Claims

Claims 1-40 are pending in the present application, with claims 1, 15, 33 and 35 being independent. Claims 1-9, 11, 12, 15, 17-23, 25, 27, and 29 have been. Claims 30-40 have been added.

Requested Action

Applicant requests favorable reconsideration of the subject application in view of the foregoing amendments and the following remarks.

Formal objections

The Abstract of the Disclosure and the title have been objected to for minor informalities therein. In response, while not conceding the propriety of the objections, the title and the Abstract have been replaced, to address the points raised by the Examiner.

Formal rejection

Claims 5, 7, 19, and 21 are rejected under 35 U.S.C. § 112, second paragraph.

In response, while not conceding the propriety of the rejection, these claims have been amended to address the points raised by the Examiner. Applicants submit that as amended, these claims now even more clearly satisfy 35 U.S.C. § 112, second paragraph.

Substantive Rejection

Claims 1-11 and 29 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,578,821 (Meisberger, et al.) in view of U.S. Patent No. 4,560,879 (Wu, et al.). Claims 12-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the patents to Meisberger, et al. and Wu, et al. and further in view of U.S. Patent No. 3,644,700 (Kruppa, et al.). Claims 15-25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the patents to Meisberger, et al. and Wu, et al.. Claims 26-28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the patents to Meisberger, et al. and Wu, et al. and further in view of the patent to Kruppa, et al.

Response to substantive rejection

In response, while not conceding the propriety of the rejections under 35 U.S.C. § 103, independent Claims 1 and 15 have been amended. Applicants submit that as amended, these claims are allowable for the following reasons.

Independent Claim 1 relates to a projection apparatus for projecting a pattern formed on a mask held by a mask stage onto a substrate comprising a charged particle beam source which emits a charged particle beam , an irradiation system which has a shaping system for shaping the charged particle beam to have an arcuate cross-section and irradiates the mask with the arcuate cross-sectional charged particle beam, a projection optical system which projects the pattern onto the substrate, and a controller.

Claim 1 has been amended to recite that the projection optical system includes a first unit having first and second magnetic lenses, and a second unit having a magnetic lens system. Claim 1 has also been amended to recite that the controller is arranged to change a ratio of currents to be respectively supplied to the first and second magnetic lenses to move a principal plane of the first unit.

In contrast, the patents to Meisberger, et al. and Wu, et al. are not understood to disclose or suggest that a projection optical system includes a first unit having first and second magnetic lenses, and a second unit having a magnetic lens system, as recited by amended Claim 1. These patents are also not understood to disclose or suggest a controller arranged to change a ratio of currents to be respectively supplied to the first and second magnetic lenses to move a principal plane of the first unit, as also recited by amended Claim 1.

The failure of these references to disclose or suggest at least these features proves fatal to establishing a prima facie case of obviousness against amended Claim 1, since MPEP §2142, requires that:

> To establish a prima facie case of obviousness... the prior art reference (or references when combined) must teach or suggest all the claim limitations.

For these reasons, amended Claim 1 is allowable over the patents to Meisberger, et al. and Wu, et al. And since Claim 15 recites similar features, it is allowable for similar reasons.

New Claim 33 relates to a projection apparatus for projecting a pattern formed on a mask onto a substrate, comprising an irridation system which irradiates the mask with a charged particle beam emerging from a charged particle beam source, a projection optical system which has a magnetic lens and projects the pattern onto the substrate, and a controller arranged to control a current to be supplied to the magnetic lens so as to adjust an image distortion of the projection optical system. In contrast, the patents to Meisberger, et al. and Wu, et al. are not understood to disclose or suggest a controller arranged to control a current to be supplied to a magnetic lens so as to adjust an image distortion of a projection optical system, as recited by Claim 33.

New Claim 35 relates to a projection apparatus for projecting a pattern formed on a mask onto a substrate, comprising an irradiation system which irradiates the mask with a charged particle beam emerging from a charged particle beam source, a projection optical system which projects the pattern onto the substrate, the projection optical system including a first unit having first and second magnetic lenses and a second unit having third and fourth magnetic lenses, and

a controller arranged to change a ratio of currents to be respectively supplied to the first and second magnetic lenses to move a principal plane of the first unit and change a ratio of currents to be respectively supplied to the third and fourth magnetic lenses to move a principal plane of the second unit. In contrast, the patents to Meisberger, et al. and Wu, et al. are not understood to disclose or suggest the projection optical system or the controller recited in independent Claim 35.

For these reasons, independent Claims 33 and 35 are allowable over this art under MPEP §2142.

The dependent claims are allowable for the reasons given with respect to the independent claims and because they recite features which are patentable in their own right. Individual consideration of the dependent claims is respectfully solicited.

In view of the above amendments and remarks, the claims are now in allowable form. Therefore, early passage to issue is respectfully solicited.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our address listed below.

Respectfully submitted,

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DC_MAIN 81988 v 1

Appln. No. 09/330,154
Atty. Docket No. 862.2866

VERSION WITH CHANGES MADE TO THE SPECIFICATION

Please substitute the following paragraph for the paragraph starting at page 1, line 15 and ending at line 23.

Conventionally, in mass production of semiconductor memory devices, an optical stepper having high productivity has been used. In the production of new-generation memory devices from 1G- and 4G-DRAM memory devices having a line width of 0.2 μm or less, the high-productivity charged particle beam exposure method having high resolving power and using charged particles, e.g., electrons or ions, is a promising technique that replaces the optical exposure method.

Please substitute the following paragraph for the paragraph starting at page 2, line 10 and ending at line 24.

In recent years, a cell projection method has been proposed as one method that solves this problem. According to this method, the repeated portion of the memory circuit pattern is divided into cells each having several μm regions, and the pattern is exposed in units of cells. With this method, the maximum region that can be exposed at once has a size [of] as small as about several μm. A plurality of deflectors are used to enlarge the exposure region. As the exposure region becomes large, deflection aberrations increase. These deflection aberrations are eliminated by

dynamic correction using focus coils and stigmators. This method can enlarge the maximum region that can be exposed at once. However, it takes a comparatively long period of time till the deflected electron beam is settled at a desired position. This decreases the productivity.

Please substitute the following paragraph for the paragraph starting at page 2, line 25 and ending at page 3, line 25.

An electron beam projection exposure method is under development which does not require a time for settling the electron beam. The projection system of an apparatus of this type uses a symmetric magnetic doublet lens. Also, an aperture for separating scattered electrons and unscattered electrons at the pattern portion and mask membrane portion, respectively, of the transfer mask from each other is arranged at a position that divides the distance between the mask and a photosensitive member in accordance with the magnification ratio. The positions of the principal planes of the two magnetic lenses of the magnetic lens are respectively set between the mask and the aperture, and at the intermediate position of the distance between the aperture and a sample coated with the photosensitive member. The two magnetic lenses can move only a small distance when they are mechanically adjusted. According to the electron beam projection exposure method, the pattern to be transferred onto the sample is divided into a plurality of partial patterns, and the divided partial patterns are formed on a mask. While an electron beam irradiates a selected partial pattern on the mask, the mask and sample are continuously moved in opposite directions. An electron beam transmitted through the mask irradiates the sample, thereby exposing the sample. Since this method does not perform electron beam scanning, it

does not take much time to settle the electron beam. As a result, this method has a higher productivity than other methods described above.

Please substitute the following paragraph for the paragraph starting at page 4, line 18 and ending at page 5, line 7.

According to the first aspect of the present invention, there is provided a projection apparatus for projecting a pattern formed on a mask held by a mask stage onto a sample on a sample stage and transferring the projected pattern, comprising a charged particle beam source, a shaping system for shaping a charged particle beam emerging from the charged particle beam source to have an arcuate cross-section, a projection optical system including a projection lens including a pair of magnetic lenses, the projection optical system being located between the shaping system and the sample stage, a driver for supplying excitation currents to the pair of magnetic lenses to drive the projection lens, and a controller for controlling [a] the ratio of the currents to be supplied from the driver to the pair of magnetic lenses to move [a] the position of a principal plane of the projection lens.

Please substitute the following paragraph for the paragraph starting at page 5, line 8 and ending at line 12.

In the projection apparatus according to the first aspect of the present invention, for example, the controller preferably controls the ratio of the currents to be supplied from the driver to the pair of magnetic lenses so as to correct [an] image distortion of the projection optical system.

Please substitute the following paragraph for the paragraph starting at page 5, line 13 and ending at line 24.

In the projection apparatus according to the first aspect of the present invention, for example, the projection optical system preferably includes a second projection lens including a pair of magnetic lenses to which excitation coil currents are supplied from the driver, and the controller preferably controls [a] the ratio of the currents to be supplied from the driver to the pair of magnetic lenses of the second projection lens to move the position of the principal plane of the second projection lens so as not to change an image position and magnification of the projection optical system when correcting [an] image distortion of the projection optical system by controlling the first projection lens.

Please substitute the following paragraph for the paragraph starting at page 5, line 25 and ending at page 6, line 7.

In the projection apparatus according to the first aspect of the present invention, for example, the projection apparatus preferably further comprises acquisition means for acquiring image information indicating a feature of an image projected onto the sample stage by measurement, and the controller preferably controls the ratio of the currents to be supplied to the pair magnetic lenses so as to correct [an] the image distortion of the projection optical system on the basis of the image information.

Please substitute the following paragraph for the paragraph starting at page 6, line 8 and ending at line 13.

In the projection apparatus according to the first aspect of the present invention, for example, the image information preferably contains information indicating [a] the radius of an image formed on the sample stage with the arcuate cross-sectional charged particle beam emerging from the shaping system.

Please substitute the following paragraph for the paragraph starting at page 6, line 14 and ending at line 19.

In the projection apparatus according to the first aspect of the present invention, for example, the controller preferably controls the ratio of the currents to be supplied to the pair of magnetic lenses, so that the measured radius coincides with [a] the theoretical radius obtained when the projection optical system has no aberration.

Please substitute the following paragraph for the paragraph starting at page 6, line 20 and ending at line 25.

In the projection apparatus according to the first aspect of the present invention, for example, the image information is preferably information indicating [an] the image height of an image formed on the sample stage with the arcuate cross-sectional charged particle beam that has passed through the shaping system.

Please substitute the following paragraph for the paragraph starting at page 7, line 1 and ending at line 7.

In the projection apparatus according to the first aspect of the present invention, for example, the controller preferably controls the ratio of the currents to be supplied to the pair of magnetic lenses, so that the actually measured image height coincides with [a] <u>the</u> theoretical image height obtained when the projection optical system has no aberration.

Please substitute the following paragraph for the paragraph starting at page 8, line 5 and ending at line 13.

In the projection apparatus according to the first aspect of the present invention, for example, the acquisition means preferably calculates [a] <u>the</u> radius of an image projected onto the sample stage on the basis of a plurality of measured coordinates, and the controller preferably controls the ratio of the currents to be supplied from the driver to the pair of magnetic lenses, so that [a] <u>the</u> radius obtained by measurement coincides with [a] <u>the</u> theoretical radius obtained when the projection optical system has no aberration.

Please substitute the following paragraph for the paragraph starting at page 9, line 7 and ending at line 25.

According to the second aspect of the present invention, there is provided a control method for a projection apparatus having a mask stage for holding a mask, a sample stage for placing thereon a sample on which a pattern formed on the mask is to be projected and transferred, a charged particle beam source, a shaping aperture for shaping a charged particle beam emerging from the charged particle beam source to have an arcuate cross-section, a projection optical system including a projection lens including a pair of magnetic lenses, the

projection optical system being located between the shaping system and the sample stage, and a driver for supplying excitation currents to the pair of magnetic lenses to drive the projection lens, comprising the acquisition step of acquiring correction information necessary for correcting [an] the aberration of the projection optical system, and the control step of controlling [a] the ratio of the currents to be supplied from the driver to the pair of magnetic lenses (doublet lens) to move [a] the position of a principal plane of the projection lens.

Please substitute the following paragraph for the paragraph starting at page 10, line 1 and ending at line 5.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the control step preferably comprises correcting [an] image distortion of the projection optical system on the basis of the correction information.

Please substitute the following paragraph for the paragraph starting at page 10, line 6 and ending at line 18.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the projection optical system preferably includes a second projection lens including a pair of magnetic lenses (doublet lens) to which excitation currents are supplied from the driver, and the control step preferably comprises controlling [a] the ratio of the currents to be supplied from the driver to the pair of magnetic lenses of the second projection

lens to move [a] <u>the</u> position of a principal plane of the second projection lens so as not to change an image position and magnification of the projection optical system when correcting [an] image distortion of the projection optical system by controlling the first projection lens.

Please substitute the following paragraph for the paragraph starting at page 10, line 19 and ending at page 11, line 2.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the acquisition step preferably includes the measurement step of acquiring by measurement image information indicating a feature of an image projected onto the sample stage as the correction information, and the control step preferably comprises correcting [an] image distortion of the projection optical system on the basis of the image information.

Please substitute the following paragraph for the paragraph starting at page 11, line 3 and ending at line 8.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the image information preferably contains information indicating [a] <u>the</u> radius of an image formed on the sample stage with the arcuate cross-sectional charged particle beam emerging from the shaping system.

Please substitute the following paragraph for the paragraph starting at page 11, line 16 and ending at line 21.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the image information is preferably information indicating [an] the image height of an image formed on the sample stage with the arcuate cross-sectional charged particle beam that has passed through the shaping system.

Please substitute the following paragraph for the paragraph starting at page 12, line 3 and ending at line 25.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the mask stage is preferably arranged between the shaping system and the projection optical system, the acquisition step preferably comprises the preparation step of causing the mask stage to hold an image distortion measurement mask having a transmitting system that passes therethrough a predetermined portion of the arcuate cross-sectional charged particle beam emerging from the shaping system, the measurement step of measuring coordinates of a position where the charged particle beam that has passed through the transmitting system becomes incident on the sample stage, and the calculation step of calculating, as correction information necessary for correcting [an] image distortion of the projection optical system, image information indicating a feature of an image projected onto the sample stage on the basis of the measured coordinates, and the control step preferably comprises controlling the ratio of the currents to be supplied from the driver to the pair of magnetic lenses to move [a] the position of a principal plane of the projection lens so as to correct [an] image distortion of the projection optical system on the basis of the correction information.

Please substitute the following paragraph for the paragraph starting at page 13, line 9 and ending at line 19.

In the control method for the projection apparatus according to the second aspect of the present invention, for example, the calculation step in the acquisition step preferably comprises calculating [a] the radius of an image projected onto the sample stage on the basis of a plurality of measured coordinates, and the control step preferably comprises controlling the ratio of the currents to be supplied from the driver to the pair of magnetic lenses, so that [a] the radius obtained by measurement coincides with a theoretical radius obtained when the projection optical system has no aberration.

Please substitute the following paragraph for the paragraph starting at page 21, line 7 and ending at line 18.

In the charged particle beam projection system, the image distortion amount measurement mask 50 is mounted on the mask stage 8 before exposure of the sample 12, and the image distortion amount is measured by using the mask 50. The image distortion amount measurement mask 50 is formed with a plurality of rectangular small punched patterns for passing the arcuate cross-sectional charged particle beams therethrough. The positions of the punched patterns are measured [at] with high precision in advance and are thus known. In Fig. 4, the rectangular holes 51, 52, and 53 are formed as three punched patterns, and their coordinate positions are known, i.e., (x1, y1), (x2, y2), and (x3, y3).

Please substitute the following paragraph for the paragraph starting at page 26, line 16 and ending at page 28, line 4.

An embodiment of a device manufacturing method utilizing the charged particle beam projection apparatus described above will be described. Fig. 7 shows the flow chart of the manufacture of a microdevice (a semiconductor chip such as an IC or LSI, a liquid crystal panel, a CCD, a thin film magnetic head, a micromachine, or the like). In step 101 (circuit design), the device pattern is designed. In step 102 (mask fabrication), a mask formed with the designed pattern is fabricated. In step 103 (wafer manufacture), a wafer is manufactured by using a material such as silicon or glass. Step 104 (wafer process) is called a pre-process. An actual circuit is formed on the wafer in accordance with lithography by using the prepared mask and wafer. Next step 105 (assembly) is called a post-process. The wafer fabricated by step 104 is formed into semiconductor chips. Step 105 includes steps such as an assembly step (dicing and bonding) and a packaging step (chip encapsulation). In step 106 (inspection), the semiconductor device fabricated in step 105 is inspected by <u>an</u> operation confirmation test, <u>a</u> durability test, and the like. The semiconductor device is completed through these steps, and is shipped (step 107). Fig. 8 shows the flow chart of this wafer process in detail. In step 111 (oxidation), the surface of the wafer is oxidized. In step 112 (CVD), an insulating film is formed on the surface of the wafer. In step 113 (electrode formation), electrodes are formed on the wafer by vapor deposition. In step 114 (ion implantation), ions are implanted in the wafer. In step 115 (resist process), a resist is applied to the wafer. In step 116 (exposure), the circuit pattern of the mask is baked on the plurality of shot regions of the wafer, and exposed in accordance with the exposure apparatus or method described above. In step 117 (development), the exposed wafer is developed. In step

118 (etching), a portion other than the developed resist image is removed. In step 119 (resist separation), the resist no longer necessary after etching is removed. These steps are repeatedly performed to form multiple circuit patterns on the wafer. When the production method of this embodiment is used, a large-size device, which is conventionally difficult to manufacture, can be manufactured at a low cost.

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MARKED-UP CLAIM SHEET

1. (Amended) A projection apparatus for projecting a pattern formed on a mask held by a mask stage onto a substrate [on a substrate stage and transferring the projected pattern,] comprising:

a charged particle beam source which emits a charged particle beam;

an irradiation system which has a shaping system for shaping [a] the charged particle beam [emerging from said charged particle beam source] to have an arcuate cross-section and irradiates the mask with the arcuate cross-sectional charged particle beam;

a projection optical system which projects the pattern onto the substrate, said projection optical system including [a projection lens including a pair of magnetic lenses, said projection optical system being located between said shaping system and said substrate stage] a first unit having first and second magnetic lenses, and a second unit having a magnetic lens system; and

[a driver for supplying excitation currents to said pair of magnetic lenses to drive said projection lens; and]

a controller [for controlling] arranged to change a ratio of [the] currents to be respectively supplied [from said driver] to said [pair of] first and second magnetic lenses to move [a position of] a principal plane of said [projection lens] first unit.

2. (Amended) The apparatus according to claim 1, wherein said controller [controls] <u>changes</u> the ratio of the currents to be <u>respectively</u> supplied [from said driver] to said [pair of] <u>first and second</u> magnetic lenses so as to correct an image distortion of said projection optical system.

3. (Amended) The apparatus according to claim 2, wherein

[said projection optical system includes a second projection lens including a pair of magnetic lenses to which excitation currents are supplied from said driver, and

said controller controls a ratio of the currents to be supplied from said driver to said pair of magnetic lenses of said second projection lens to move the position of the principal plane of said second projection lens so as not to change an image position and magnification of said projection optical system when correcting an image distortion of said projection optical system by controlling said first projection lens.]

<u>said second unit includes third and fourth magnetic lenses as the magnetic lens system, and</u>

<u>said controller is further arranged to change a ratio of currents respectively supplied to said third and fourth magnetic lenses to move a principal plane of said second unit so as not to change an image position and magnification of said projection optical system when moving the principal plane of said first unit.</u>

4. (Amended) The apparatus according to claim 1, wherein

said projection apparatus further comprises an acquisition [means] system [for acquiring] which acquires image information indicating a feature of an image projected onto [said] a substrate stage for supporting the substrate by measurement, and

said controller [controls] is further arranged to change the ratio of the currents to be respectively supplied to said [pair] first and second magnetic lenses so as to correct an image distortion of said projection optical system on the basis of the image information.

5. (Amended) The apparatus according to claim 4, wherein [the image information contains] said acquisition system acquires image information containing information indicating a radius of an image formed on said substrate stage with the arcuate cross-sectional charged particle beam emerging from said shaping system.

6. (Amended) The apparatus according to claim 5, wherein said controller [controls] is further arranged to change the ratio of the currents to be respectively supplied to said [pair of] first and second magnetic lenses, so that the measured radius coincides with a theoretical radius obtained when said projection optical system has no aberration.

7. (Amended) The apparatus according to claim 4, wherein [the image information is] said acquisition system acquires image information containing information indicating an image height of an image formed on said substrate stage with the arcuate cross-sectional charged particle beam that has passed through said shaping system.

8. (Amended) The apparatus according to claim 7, wherein said controller [controls] is further arranged to change the ratio of the currents to be respectively supplied to said [pair of] first and second magnetic lenses, so that the actually measured image height coincides with a theoretical image height obtained when said projection optical system has no aberration.

9. (Amended) The apparatus according to claim 4, wherein

[said mask stage is arranged between said shaping system and said projection optical system,]

said acquisition [means] system comprises

an image distortion measurement mask having a transmitting system that passes therethrough a predetermined portion of the arcuate cross-sectional charged particle beam [emerging from said shaping system], said mask being held by said mask stage during measurement, and

a measurement unit for measuring coordinates of a position where the charged particle beam that has passed through said transmitting system becomes incident on said [sample] substrate stage, and

said acquisition system calculates image information indicating a feature of an image projected onto said substrate stage [is calculated] on the basis of the measured coordinates.

11. (Amended) The apparatus according to claim 10, wherein

said acquisition [means] system calculates a radius of an image projected onto said substrate stage on the basis of a plurality of measured coordinates, and

said controller [controls] is further arranged to change the ratio of the currents to be respectively supplied [from said driver] to said [pair of] first and second magnetic lenses, so that a radius obtained by measurement coincides with a theoretical radius obtained when said projection optical system has no aberration.

12. (Amended) The apparatus according to claim 9, wherein

said acquisition [means] system further comprises a substrate having a mark, said substrate being placed on said substrate stage during measurement, and

said measurement unit detects backscatter electrons from said substrate, thereby measuring coordinates of a position where the charged particle beam that has passed through said transmitting system becomes incident on said substrate stage.

15. (Amended) A control method for a projection apparatus having a mask stage for holding a mask, [a substrate stage for placing thereon a sample on which a pattern formed on said mask is to be projected,] a charged particle beam source which emits a charged particle beam, an irradiation system which has a shaping system for shaping [a] the charged particle beam [emerging from said charged particle beam source] to have an arcuate cross-section and irradiates the mask with the arcuate cross-sectional charged particle beam, and a projection optical system which projects the pattern onto a substrate, said projection optical system including [a projection lens including a pair of magnetic lenses, said projection optical system being located between said shaping system and said substrate stage] a first unit having first and second magnetic lenses,

and a second unit having a magnetic lens system, [and a driver for supplying excitation currents to said pair of magnetic lenses to drive said projection lens,] said method comprising:

the acquisition step of acquiring correction information necessary for correcting aberrations of said projection optical system; and

the control step of [controlling] changing a ratio of [the] currents to be respectively supplied [from said driver] to said [pair of] first and second magnetic lenses to move [a position of] a principal plane of said [projection lens] first unit.

17. (Amended) The method according to claim 16, wherein

[said projection optical system includes a second projection lens including a pair of magnetic lenses to which excitation currents are supplied from said driver, and

the control step comprises controlling a ratio of the currents to be supplied from said driver to said pair of magnetic lenses of said second projection lens to move a position of a principal plane of said second projection lens so as not to change a field position and magnification of said projection optical system when correcting an image distortion of said projection optical system by controlling said first projection lens.]

said second unit has third and fourth magnetic lenses as the magnetic lens system, and

the control step comprises changing a ratio of currents respectively supplied to said third and fourth magnetic lenses to move a principal plane of said second unit so as not to change an image position and magnification of said projection optical system when moving the principal plane of said first unit.

18. (Amended) The method according to claim 15, wherein

the acquisition step includes the measurement step of acquiring by measurement image information indicating a feature of an image projected onto [said] a substrate stage for supporting the substrate as the correction information, and

the control step comprises correcting an image distortion of said projection optical system on the basis of the image information.

19. (Amended) The method according to claim 18, wherein [the image information contains] the acquisition step comprises the step of acquiring image information containing information indicating a radius of an image formed on said substrate stage with the arcuate cross-sectional charged particle beam emerging from said shaping system.

20. (Amended) The method according to claim 19, wherein the control step comprises controlling the ratio of the currents to be respectively supplied to said [pair of] first and second magnetic lenses, so that the measured radius coincides with a theoretical radius obtained when said projection optical system has no aberration.

21. (Amended) The method according to claim 18, wherein [the image information is] the acquisition step comprises the step of acquiring image information containing information indicating an image height of an image formed on said substrate stage with the arcuate cross-sectional charged particle beam that has passed through said shaping system.

22. (Amended) The method according to claim 21, wherein the control step comprises [controlling] changing the ratio of the currents to be respectively supplied to said [pair of] first and second magnetic lenses, so that the actually measured image height coincides with a theoretical image height obtained when said projection optical system has no aberration.

23. (Amended) The method according to claim 15, wherein

[said mask stage is arranged between said shaping system and said projection optical system,]

said acquisition step comprises

the preparation step of causing said mask stage to hold an image distortion measurement mask having a transmitting system that passes therethrough a predetermined portion of the arcuate cross-sectional charged particle beam [emerging from said shaping system],

the measurement step of measuring coordinates of a position where the charged particle beam that has passed through said transmitting system becomes incident on [said] a substrate stage for supporting the substrate, and

the calculation step of calculating, as correction information necessary for correcting an image distortion of said projection optical system, image information indicating a feature of an image projected onto said substrate stage on the basis of the measured coordinates, and

the control step comprises [controlling] changing the ratio of the currents to be respectively supplied [from said driver] to said [pair of] first and second magnetic lenses to move [a position of] a principal plane of said [projection lens] first unit so as to correct an image distortion of said projection optical system on the basis of the correction information.

25. (Amended) The method according to claim 24, wherein

the calculation step in the acquisition step comprises calculating a radius of an image projected onto said [sample] substrate stage on the basis of a plurality of measured coordinates, and

the control step comprises [controlling] changing the ratio of the currents to be respectively supplied [from said driver] to said [pair of] first and second magnetic lenses, so that a radius obtained by measurement coincides with a theoretical radius obtained when said projection optical system has no aberration.

29. (Amended) A method of manufacturing a device, comprising the steps of:

fixing a mask on said mask stage of said projection apparatus according to claim 1;

placing a [sample] substrate on [said sample] a substrate stage of said projection apparatus; and

transferring a pattern formed on [said] the mask onto [said sample] the substrate.

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